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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/830,120	04/23/2004	Jung-hyun Lee	249/456	9015

27849 7590 01/29/2007  
LEE & MORSE, P.C.  
3141 FAIRVIEW PARK DRIVE  
SUITE 500  
FALLS CHURCH, VA 22042

EXAMINER
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STARK, JARRETT J

ART UNIT	PAPER NUMBER
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2823

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/29/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/830,120

Applicant(s)

LEE ET AL.

Examiner

Jarrett J. Stark

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 November 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) 12-24 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 June 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Response to Arguments*

Applicant's arguments filed 11/20/2006 have been fully considered but they are not persuasive.

As claim 1 is currently written, the broad claim language does not distinctly exclude the disclosed stack type capacitor structure as shown in Figure 3 of Aoki et al. As shown below layers 5, 6, and 8 are all metal layers that make up an upper and lower electrodes. Either Layer 8 or 6 can be viewed as second metal layer that completely fills in the space defined by the first metal layer 5 and/or 6.

Fig. 2

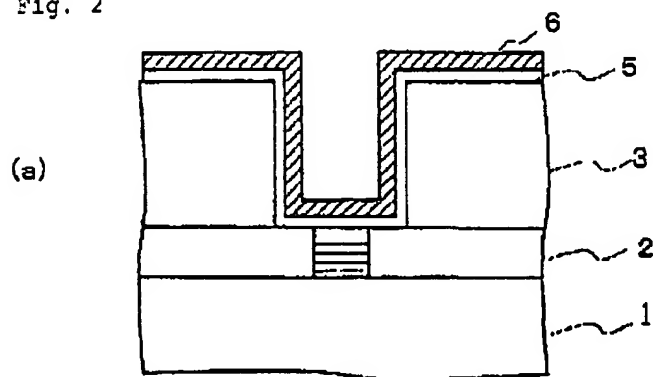
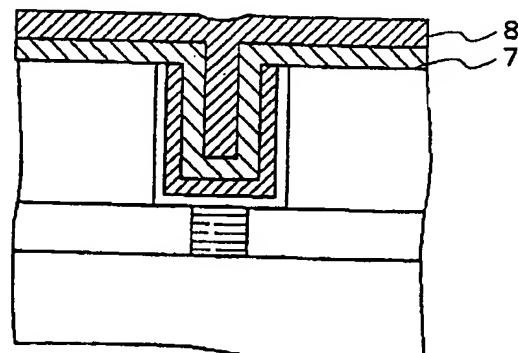


Fig. 3



From the interpretation that layer 8 is the second metal layer, as shown in the above figure the first metal layer 6 defines a cylindrical shape. This layer is the lower electrode. This lower cylindrical shaped electrode includes a second metal layer 8 that fills the lower electrode. As the claim is currently worded the lower electrode is not

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required to be made of first and second metal layers and therefore does not exclude an additional layer 7 in between.

Additionally, from the interpretation that layer 6 is the second metal layer the adhesive layer 5 can be formed from Wn or Ti which are metal (see paragraph [0034]), and lower electrode metal film 6 fills in the metal adhesive film 5 forming a lower filled in cylindrical shaped electrode formed of contacting/consecutive first and second metal films. A dielectric layer 7 is formed on the first and second metal layers that comprise the lower electrode and then an upper electrode 8 is formed on the dielectric layer. Thus Aoki meets all of the claim limitations.

The additional argument are dependent from the argument above, and therefore considered moot in view of the above responses.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**Claims 1 and 5-8** are rejected under 35 U.S.C. 102(b) as being anticipated by Aoki et al. (US 2002/0072191).

**Regarding claim 1, Aoki et al.** discloses a stack-type capacitor comprising:

a lower electrode; (Aoki et al., Fig. 2 ref #'s 5&6)

a dielectric layer formed on the lower electrode; (Aoki et al., Fig. 2 ref # 7)

and an upper electrode formed on the dielectric layer, (Aoki et al., Fig. 3 ref # 8)

wherein the lower electrode includes:

a first metal layer having a cylindrical shape and defining a cylindrical space; and (Aoki et al., Fig. 2 ref # 6)

a second metal layer completely filling the cylindrical space defined by the first metal layer (Aoki et al., Fig. 3 ref # 8)

Fig. 2

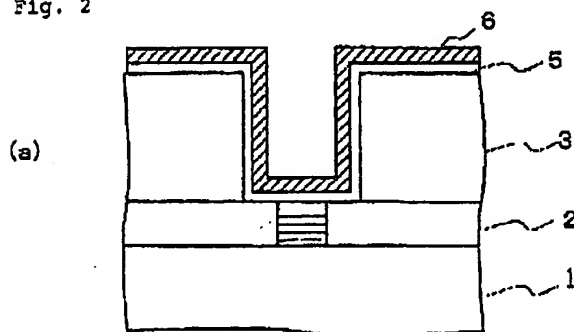
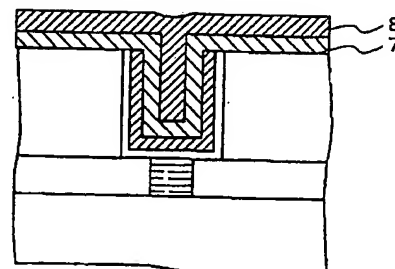


Fig. 3



**Regarding claim 5, Aoki et al.** discloses a semiconductor memory device including a stack-type capacitor, the device comprising a transistor and a capacitor, wherein the capacitor includes: (Aoki et al., paragraph [0032])

a lower electrode; (Aoki et al., Fig. 2 ref #'s 5&6)

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a dielectric layer formed on the lower electrode; (Aoki et al, Fig. 2 ref # 7)

and an upper electrode formed on the dielectric layer, (Aoki et al, Fig. 3 ref # 8)

wherein the lower electrode includes:

a first metal layer having a cylindrical shape and defining a cylindrical space; and

(Aoki et al, Fig. 2 ref # 6)

a second metal layer completely filling the cylindrical space defined by the first metal layer (Aoki et al, Fig. 3 ref # 8)

**Regarding claim 6, Aoki et al.** discloses the device as claimed in claim 5, wherein the transistor is electrically connected to the capacitor by a conductive plug. (Aoki et al, paragraph [0032])

**Regarding claims 7 & 8, Aoki et al.** discloses the device as claimed in claim 6, wherein a diffusion barrier layer is formed between the lower electrode and the conductive plug (Aoki et al, paragraph [0032]).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 2-4 and 9-11** are rejected under 35 U.S.C. 103(a) as being unpatentable over Aoki et al. (US 2002/0072191) in view of Kim et al. (US 2001/00544730).

**Regarding claims 2 & 9**, Aoki discloses the capacitor as claimed in claim 1 & 5.

Aoki does not expressly disclose wherein the first metal layer is a ruthenium layer and the second metal layer is a nitride and aluminum layer.

Kim discloses wherein the metal layers of the capacitor can be formed from Ru and TaAlN (Kim, paragraph [0013]).

The two references are analogous art because they are from the same field of endeavor of forming a cylindrical stack type capacitor.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use TaAlN to form the metal layers of the stack capacitor, since it has been held to be within the general skill of a worker in the art to select a known material on the base of its suitability, for its intended use involves only ordinary skill in the art. *In re Leshin*, 125 USPQ 416.

Therefore, it would have been obvious to combine Kim with Aoki to obtain the invention as specified.

lower electrode in a capacitor according to the embodiment of the present invention is formed of a refractory metal such as Ti, Ta and W or a refractory metal compound such as TiN, TiSiN, TiAlN, TaN, TaSiN, TaAlN and WN. In particular, when the lower electrode 10 has a three-dimensional structure such as a cylindrical shape, a refractory metal or

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refractory metal compound deposited by CVD or ALD providing good step coverage is preferable. (Kim, paragraph [0031])

**Regarding claim 3 & 10,** Aoki in view of Kim disclose the capacitor as claimed in claim 2 & 9, wherein the nitride and aluminum layer is a titanium aluminum nitride layer or a tantalum aluminum nitride layer. (Kim, paragraph [0031])

**Regarding claim 4 & 11,** Aoki in view of Kim disclose the capacitor as claimed in claim 2 & 9, wherein the upper electrode is a ruthenium layer. (Kim, paragraph [0013])

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jarrett J. Stark whose telephone number is (571) 272-6005. The examiner can normally be reached on Monday - Thursday 7:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JJS

January 9, 2007

  
MICHELLE ESTRADA  
PRIMARY EXAMINER